

Example #21: A 0.015 kg bullet is fired horizontally into a 3.0 kg block of wood suspended by a long cord. The bullet sticks in the block. Compute the original velocity of the bullet if the impact causes the block to swing 10 cm above its initial level.

→ assume negligible energy lost in swing, so

$$E_T = E_K (\text{bottom}) = E_P (\text{top})$$

block and
bullet

$$\frac{1}{2} (3 + .015) v^2 = (3 + .015)(9.8)(.10)$$

$v = 1.4 \text{ m/s}$ at bottom of swing,
after bullet collides with block.

→ use cons. of momentum to find bullet
velocity before the collision

before

$$p_T = .015 v$$

after

$$p_T = (3 + .015)(1.4)$$

$$= 4.221$$

$$.015 v = 4.221$$

$$v = 2.8 \times 10^2 \text{ m/s}$$